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(54) **A breadmaking method for the production of crisp long term preservation small loaves, and a system therefor.**

(57) A low water content (lower than than 40 bulk % based on the flour bulk) breadmaking dough prepared from a high gluten content (proteins in excess of 12%) flour, is rolled until a visco-elastic characteristic breadmaking dough is obtained; metered amounts of the breadmaking dough are then pressed into respective molds to yield a compressed, sheet-like loaf blank.

The sheet-like loaf blank is rolled up, given a desired shape, allowed to leaven, and following a baking step, dried down to a lower moisture content than 10%.

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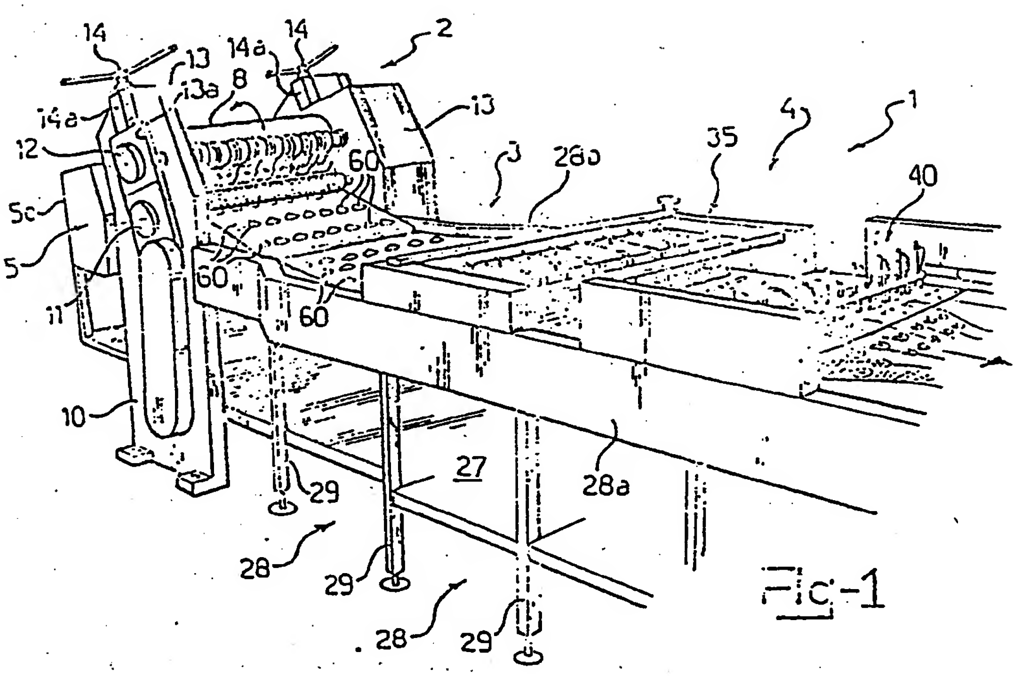
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FIG-1

DESCRIPTION

This invention relates to a breadmaking method for producing crisp, long term preservation, small loaves on an industrial scale.

There exists a demand for a bread which can retain enhanced fragrant and crisp properties over time.

Current techniques for making bread from a paste composed of water, flour, and yeast, may be reduced to the following cycle: dough is first made as homogeneous as possible through successive mechanical processing, allowed to leaven, cut into pieces providing a stock which is fashioned into desired forms, thereafter, following as a rule further leavening, the bread forms are baked.

The structure of bread so made is generally characterized by a dense outer crust and a fine cellular underlayer and a soft elastic inner crumb of a more or less pronounced character which is unevenly distributed.

However, it is a well known fact that traditional bread undergoes, after a more or less short time period, a series of structural and organoleptic changes leading to its first becoming stale and then dry.

Bread crumb in particular is liable to undergo such structural alterations and progressively lose its elastic character to become coarse and abrasive, and therefore, unpalatable.

Other prior techniques for processing flour-based pastes yield bread-substitutive products, mainly crackers and bread sticks, which notoriously preserve well for a relatively long time.

It should be noted, however, that such substitutes have none of the fragrant and appetizing qualities of new bread.

Thus, such products fail to meet the above-mentioned demand.

The problem underlying this invention is, therefore, that of providing a novel breadmaking method whereby it becomes possible to produce a small loaf on an industrial scale which can retain all the characteristics of new bread over time, and specifically its flavor, fragrance, and crispness.

Broadly the solutive idea for that problem is one of dealing with breadmaking dough, directly downstream of its preparation, to modify its chemical and physical state through violent mechanical treatments whereby baking will yield a loaf the whole structure whereof is similar to the crust of traditional bread, being finely cellular and evenly distributed.

That solutive idea is realized by a breadmaking method for producing crisp long term preservation small loaves, which is characterized in that it comprises the following process steps:

preparation of a breadmaking dough from high gluten content flour (proteins in excess of 12%) and water in lower amounts than 40 bulk % based on flour bulk, and as additivated with yeast,

rolling said dough until a breadmaking dough having visco-elastic characteristic is obtained,

feeding a metered amount of said breadmaking dough into a mold cavity, the volume of said amount being substantially equal to the volume of said mold cavity,

compressing said amount of breadmaking dough by direct action

thereon until it fills by viscoelastic flowing said mold cavity substantially throughout, yielding a sheet-like compressed loaf blank,

releasing the pressure on the sheet-like blank and shaking it out of the mold cavity,

imparting said sheet-like blank with the final loaf shape,

leavening the product from the preceding step, and

baking the leavened product and drying it down to a lower moisture content than 10%.

While this method runs counter to traditional breadmaking techniques, which all observe a common criterion of avoiding, as far as possible, any violent mechanical handling of the breadmaking dough downstream of the rolling step in order to minimize perturbation of the leavening process, it has been found in actual practice that the resulting product was stable over time from both a chemical and physical standpoint and an organoleptic standpoint, and accordingly, adapted for long term storage without alteration of its starting fragrant and crisp properties.

An illustrative and not limitative example will be described herein below of an application of the inventive method.

EXAMPLE 1

To prepare a breadmaking dough, the following ingredients were used:

100 kg flour having a protein content of about 13% by weight, which when analyzed by the Chopin Method, gave the following index values:

W = 260, P/L = 0.5;

35 kg water;

3 kg breadmaking yeast.

The mixture was additivated with 5 kg olive oil, sodium chloride, and malt in conventional dosages.

The kneading operation was conducted in two stages separated by a rest period of about 6 hours (two-stage dough).

The resulting dough was particularly consistent, and was then subjected to a series of successive rolling steps on a rolling machine until it yielded a homogeneous web of breadmaking dough (of the so-called "hard dough" type) exhibiting visco-elastic characteristics and being 25 mm thick.

The breadmaking dough thus obtained has a specific density of 1.05 kg/dm³.

The breadmaking dough web was then fed into the nip of two parallel rolls driven rotatively at a peripheral velocity of 0.19 m/sec and held in tangential contact along a common generatrix.

One of those rolls had plural molding cavities of triangular shape formed in its skirt which have an average depth of 4 mm, the other roll having a smooth surface skirt.

Dough would only be passed between the rolls with an empty mold present directly upstream of the contact generatrix therebetween.

It has been found that in going through the roll nip, the dough underwent a high and rapid compression causing it to flow viscoelastically to almost completely fill a respective molding cavity.

Downstream of the rolls, a compressed sheet-like stock was obtained that was made easier to shake out of the mold cavity by the elastic recovery tendency of breadmaking dough.

The sheet-like stock was then rolled up and allowed to leaven to a 45% swell by volume.

The leavened product was then baked at a temperature of about 250 to 270 degrees centigrade to yield a sample small loaf of a rich brown color which was both consistent and crisp.

The sample loaf was then dried to a moisture content of 5%, and on breaking, it showed a fine cellular and homogeneously dispersed structure.

20 days later, the sample loaves so obtained showed no significant changes in consistency, flavor, fragrance, and crispness.

In the course of further tests, it was found that best results are to be obtained by using high gluten content flours (with a protein content of no less than 12%).

By way of non-limitative example, a system will be now described for producing crisp small loaves on an industrial scale, which is particularly suitable to implement the inventive method.

In the accompanying drawings:

Figure 1 is a fragmentary perspective view of an industrial breadmaking system for producing long term preservation crisp loaves;

Figures 2 and 3 are also fragmentary views of the same system as shown in Figure 1, being respectively a top plan view and a diagramatic longitudinal section view thereof;

Figures 4 and 5 show, respectively in perspective and in section, a detail of the pressure molding station for the compressed sheet-like loaf stock;

Figure 6 is a diagramatic longitudinal section view through the loaf final forming station; and

Figure 7 depicts in perspective a detail of the station of Figure 6.

A system for producing crisp small loaves on an industrial scale comprises a kneading machine, a rolling machine, a forming machine, a leavening chamber, a baking oven, and a drier, in that order.

In the accompanying drawings, only the forming machine, comprehensively designated 1, is shown, the remaining machines being omitted because quite conventional.

The forming machine 1 comprises, in turn, a molding station 2, a wetting station 3, and a final forming station 4, in that order.

A breadmaking dough being processed will move through the above-mentioned machines in the order indicated.

The molding station 2 comprises a feeder assembly 5 composed of a frame 5c which carries rotatably a plurality of power driven rolling roll pairs 5a,5b with parallel axes.

A gap is defined between each roll pair 5a,5b wherethrough a breadmaking dough 6 is made to pass.

The dough 6 reaches the feeder assembly 5 in the form of plural breadmaking dough webs (eight webs in the example shown) and goes sequentially through the nips of all the roll pairs 5a,5b.

The size of said gap, for adjoining roll pairs, decreases in the direction of advance of the dough 6 as indicated by the arrow A.

Downstream of the feeder assembly 5, there are a pair of rolls, respectively a die roll 7 and a backup roll 8, lying parallel to each other and to the rolling rolls 5a,5b and being driven counter-rotatingly by motors, not shown.

The rolls 7 and 8 are journalled on a pair of shoulders 13

of a framework 10 by means of respective seals 11 and 12.

The seals 12 are supported slidingly within respective seats 13a formed in the shoulders 13.

Respective nut 14a and screw 14 adjusters are mounted on each shoulder 13 and connected to their corresponding seal 12 to adjust its position relatively to the seal 11, and change, if desired, the spacing between the rolls 7 and 8.

The screw adjusters 14,14a form a means of positioning the roll 8 relatively to the roll 7; such means are essentially provided to position said rolls in mutual contact relationship along a common generatrix B.

The roll 7 has a plurality of molding cavities 15, hereinafter referred to as the "molds", which are distributed regularly across its skirt at spaced-apart cylinder segments. The number of the molds 15 which are aligned along any generatrix line of the roll 7 is equal to the number of the webs of dough 6 oncoming to the feeder assembly 5.

The molds 15 have a substantially triangular shape with rounded off apices, and have their bottoms partially coated with an adhesion-preventing material, such as an epoxy resin.

The roll 8 has a smooth surface skirt and doctoring members 16 are active thereon, one for each cylindrical segment of molds 15. The doctoring members 16 are carried on a shaft 17 which extends between the shoulders 13 and have a blade 16a set to the skirt of the roll 8 directly downstream of the generatrix B.

The molding station 2 further comprises a carpet conveyor 20 trained in a closed loop around respective rollers 21, and having one end held close to the roll 7 by a nose 22. The carpet 20 has a working conveying surface 23.

A levelling roller 24 is supported idly between the shoulders 13 downstream of the rolls 7,8 and above the working surface 23; the roller 24 is rubber foam lined.

The wetting 3 and final forming 4 stations are both carried on a frame 28 extending mainly in a longitudinal direction and being provided with a pair of longitudinal stringers 28a and 28b which are provided, in turn, with legs 29. To the legs 29, at a region underlying the longitudinal stringers 28a,28b, there is also connected a pan 27 for collecting any scrap dough.

The wetting station 3 comprises, downstream of the carpet 20, a number of mesh conveyors 31 equal in number to molds 15 aligned along any generatrix line of the roll 7, and moving in the same direction as the carpet 20 and fanning out in the direction of the arrow A.

The product travelling on the mesh conveyors 31 is subjected to water spray jets which are delivered at preset rate from spray members indicated diagramatically at 21a.

The final forming station 4 comprises a carpet conveyor 30 having a working run 32 coplanar with the mesh conveyors 31.

The carpet 30 is stretched between rollers 30a and 30b journalled on the longitudinal stringers 28a and 28b.

Between the mesh 31 and carpet 30 conveyors there intervene a pair of rolling rolls 33, in parallel stacked relationship, which are powered and laid across the direction of advance of the product being processed (arrow A).

A gap is defined between the rolls 33 which has a set width to let said product being processed therethrough.

The rolling rolls 33 are also journalled on the longitudinal stringers 28a and 28b.

The piston rods 45 are drawn up, by respective cylinders 44 forming drive means therefor, to a raised position toward the crosspiece 43 each time that the movement of the slide 41 takes place in the opposite direction to the advancing product being processed, and are extended out, with their free ends brought close to the carpet 30 on said movement taking place in the same direction as the arrow A.

The piston rods 45 perform, therefore, with respect to the frame 28, a rectangular cycle movement in a perpendicular plane to the working run of the carpet 30 in parallel with the arrow A.

Of that cyclic movement, the travel path of the rods 45 down toward the carpet 30 will be referred to as the "active path".

The folding device 40 further comprises a corresponding plurality of pairs of juxtapposed templates 51, each pair delimiting a passageway located along the active path of the corresponding piston rod 45.

The template pairs 51 are mounted stationary on the frame 28 and have confronting surfaces 52 which are curved and concave in a symmetrical arrangement with respect to the plane wherein the corresponding piston rod moves.

Each template pair 51 overlies, over at least some distance, a corresponding conveyor belt 54 provided for transporting the product to the leavening chamber and then to the baking oven.

The production steps for crisp small loaves made with the inventive method will be now described in connection with the system just described.

The ingredients are kneaded in two stages, that is two discrete kneading sub-steps separated by a rest period, using high gluten content (protein content of about 13-14%) flour,

Directly downstream of the rolls 33, a portion of the working run 32 of the carpet conveyor 30 is acted upon by a roll-up device 35.

The device 35 comprises a frame 36 extending across the direction (A) of advance of the product being processed and being fastened to the longitudinal stringers 28a,28b at a region overlying the carpet 30.

A plurality of clamps 37 extending vertically to the working run 32 of the carpet 30 are hooked on the frame 36 which are provided proximate the working run with respective pads 37a of felt or the like comparatively soft material having a high frictional coefficient.

The pads 37 are spring mounted to their respective clamps 37.

The station 4 further comprises a folding device 40 having a slide 41 movable along runways 42, in turn made fast with the longitudinal stringers 28a,28b.

The slide 41 has a crosspiece 43 which extends bridge-fashion over the working run of the carpet conveyor 30. Mounted on the crosspiece 43 are a plurality of fluid-operated cylinders 44 each having a piston rod 45 which extends in a perpendicular direction to the working run 32 of the carpet 30 and a corresponding plurality of brackets 46 located between the crosspiece 43 and said working run 32. The brackets 46 have a bore 47 wherethrough the corresponding piston rod 45 is guided. Said brackets 46 are effective to prevent, with the piston rod 45 raised, the product being processed from sticking to the piston rod.

The slide 41 is reciprocated in a parallel direction to the arrow A by a connecting rod-crank lever type of linkage generally indicated at 50.

water in the amount of about 35-37 bulk % based on the dry flour, yeast, olive oil, malt, and salt bulk.

The resulting dough is subjected to sequential rolling passes until a homogeneous breadmaking dough web is obtained which has visco-elastic characteristics.

The dough web is then fed into a rolling machine where roll pairs will roll it into decreasing thickness stocks.

The last roll pair in the rolling machine will split the rolled dough into plural webs 6, as shown in the drawings.

The breadmaking dough webs are then taken to the feeder assembly 5, wherein they undergo additional thickness reduction by rolls 5a,5b.

For each doough web there corresponds, as mentioned previously, one cylindrical segment having molds 15 in the die roll 7.

The speed of the roll pairs 5a,5b is contant over time, and constant is accordingly the amount of the dough which is being fed into the nip of the rolls 7 and 8, while drawing of dough into any mold 15 of the roll 7 would be cyclic and dependent on an empty mold moving past the feeder 5.

Thus, each dough web 6 upstream of the rolls 7 and 8 will be subjected to an intermittent forward movement at the same rate as the respective molds 15 moving past.

During the await step for a fresh empty mold 15, the dough 6 undergoes a consequent sligth build-up upstream of the rolls 7,8.

When a mold 15 is present directly upstream of the generatrix line B of contact of the rolls 7,8, the dough build-up will be drawn into it in a volume approximately equal to the volume of the mold 15 cavity.

The dough is forced to flow visco-elastically to almost completely fill the cavity of the mold 15 while contributing, on account of its consistency and toughness, a significant elastic reaction force, to deliver, downstream of the generatrix line B and for each mold 15, a compressed sheet-like stock 60.

By way of illustration, it has been found that rolls 7,8 820 mm long and having an outside diameter of 270 mm, with eight mold cavities 15 aligned on one generatrix line, are subjected in operation to load in the 15 to 30 tons range.

The stocks or blanks 60 undergo, directly downstream of the generatrix line B, a slight amount of elastic recovery which results in their becoming detached from the respective molds.

Any blanks 60 sticking to the backup roll 8 would be removed therefrom by doctoring means 16.

The blanks 60 are then laid onto the carpet conveyor 20 and spread thereover by the levelling roller 24.

They are wetted in going through the station 3 in a manner already described previously, and subjected to further rolling through the nip of the rolls 33.

Downstream of the rolls 33, each blank will have a leading portion (in the direction of the arrow A) which curls slightly upward to invite subsequent rolling up at the device 35.

In moving underneath the felt pads 37a, the blanks 60 entrained by the carpet 30 are rolled up into a substantially cylindrical configuration indicated at 61 in the drawings.

The cylindrical blanks 61 are taken forward by the carpet 30 toward the templates 51 of the folding device 40.

Directly upstream of the templates 51, each blank 61 will be reached by the piston rod 45 of its corresponding fluid-operated

cylinder 44, taken by the slide 41 in the opposite direction to the advancing direction of the carpet 30. Each piston rod 45 is lowered onto the carpet 30 directly upstream of a corresponding blank 61 and follows it in its path of travel up to the templates 51, to force it through the gap between the confronting surfaces 52 of the latter.

Thus, the blanks 61 will be bent into a crescent-like shape as indicated at 62 in the drawing.

From the templates 51 they are then discharged onto the belt conveyors 53, and whence onto the carpet conveyor 54, to be taken to a leavening chamber where they are allowed to stand at a temperature of 36°C for about one hour, their volume increasing by 45%.

The leavened blanks are then baked at a temperature in the 250° to 270°C range.

On exiting the oven, they are dried until their moisture content drops to about 5%, and then packaged into bags, boxes, or other appropriate commercial packaging containers.

CLAIMS

1. A breadmaking method for producing crisp, long term preservation, small loaves, characterized in that it comprises the following steps:

preparation of a breadmaking dough from high gluten content (proteins in excess of 12%) flour and water in lower amounts than 40 bulk % based on flour bulk, and as additivated with yeast;

rolling said diugh until a breadmaking dough having visco-elastic characteristic is obtained;

feeding a metered amount of said breadmaking dough into a mold cavity, the volume of said amount being substantially equal to the volume of said mold cavity;

compressing said amount of breadmaking dough by direct action thereon until it fills by visco-elastic flowing said mold cavity substantially throughout, yielding a sheet-like compressed loaf blank;

releasing the pressure on the sheet-like blank and shaking it out of the mold cavity;

imparting said sheet-like blank with the final loaf shape;

leavening the product from the preceding step; and

baking the leavened product and drying it down to a lower moisture content than 10%.

2. A system for producing crisp, long term preservation, small loaves on an industrial scale, comprising a forming machine 1 having a molding station 2 and a forming station 4 laid sequentially to each other, characterized in that said molding station 2 includes a pair of counter-rotating powered rolls 7,8 journalled on a framework 10 with their axes parallel, one of said rolls 7,8 having a plurality of mold cavities 15 uniformly distributed across its skirt, the other of said

rolls 7,8 having a smooth surface skirt, said rolls 7,8 being mounted to contact each other along a common generatrix line B.

3. A system according to Claim 2, characterized in that it comprises, upstream of said rolls 7,8, a feeder assembly 5 including a plurality of parallel, sequentially-laid powered roll pairs 5a,5b, between said pairs there being defined a corresponding gap of decreasing width from the remotest roll pair 5a,5b from said first-mentioned rolls 7,8 to the closest roll pair 5a,5b to said first-mentioned rolls 7,8.

4. A system according to Claim 2, characterized in that said mold cavities 15 are at least partly coated with an adhesion-preventing material.

5. A system according to Claim 4, characterized in that said adhesion-preventing material is an epoxy resin.

6. A system according to Claim 2, characterized in that the mold cavities 15 have a triangular shape and a depth of about 4 mm.

7. A system according to Claim 2, wherein said forming station 4 comprises a frame 28 carrying a carpet conveyor 30 mounted thereto, and a folder device 40 supported on said frame over a working run 32 of said conveyor 30, characterized in that said folding device 40 includes a slide 41 guided on said frame 28 in a parallel direction to the conveyor working run 32, a crosspiece 43 fast with said slide 41 and extending bridge-like over the working run 32 of the conveyor, a plurality of rods 45 supported movingly on said crosspiece 43 and extending perpendicularly to said working run 32, drive means 44 for reciprocating said rods 45 toward and away from said working run, and a corresponding plurality of template pairs 51 attached to said frame 28 on said working run 32, the templates 51 in each pair being laid symmetrically with respect to the plane of movement of a respective

one of said rods 45 and mutually set apart from said plane to delimit a passageway for said rod therebetween.

8. A system according to Claim 7, characterized in that said rods 45 are each incorporated to a corresponding fluid-operated cylinder 44 mounted on said crosspiece 43 and forming a drive member for the respective rod. 45

9. A system according to Claim 7, characterized in that it comprises, for each rod 45, a clamp 46 rigid with said crosspiece 43 on the side next to said conveyor 30, each clamp 46 being formed with a respective bore 47 wherethrough a corresponding rod 45 is made to pass.

10. A system according to Claim 7, characterized in that said templates 51 have concave curved confronting surfaces. 52

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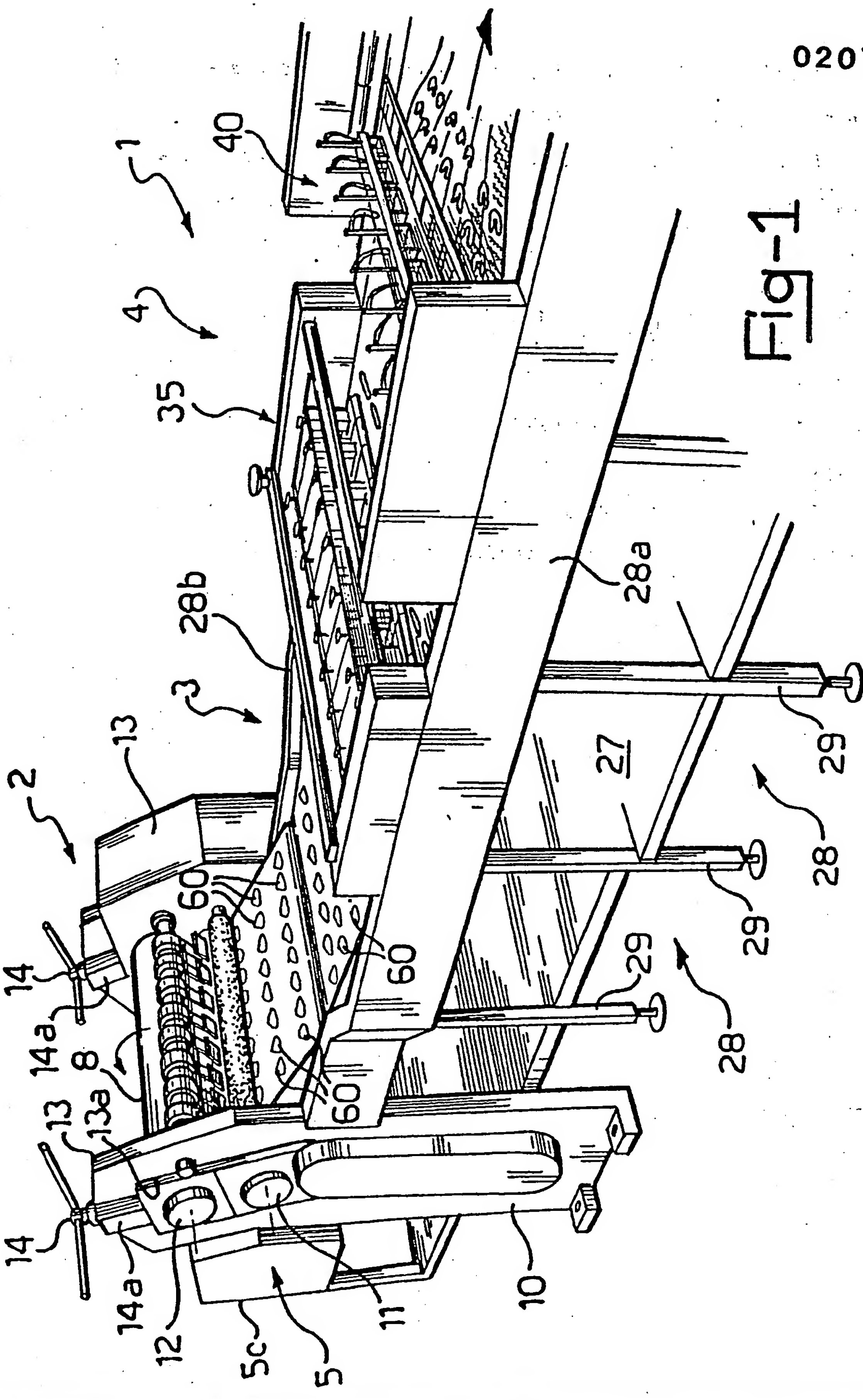

Fig-1

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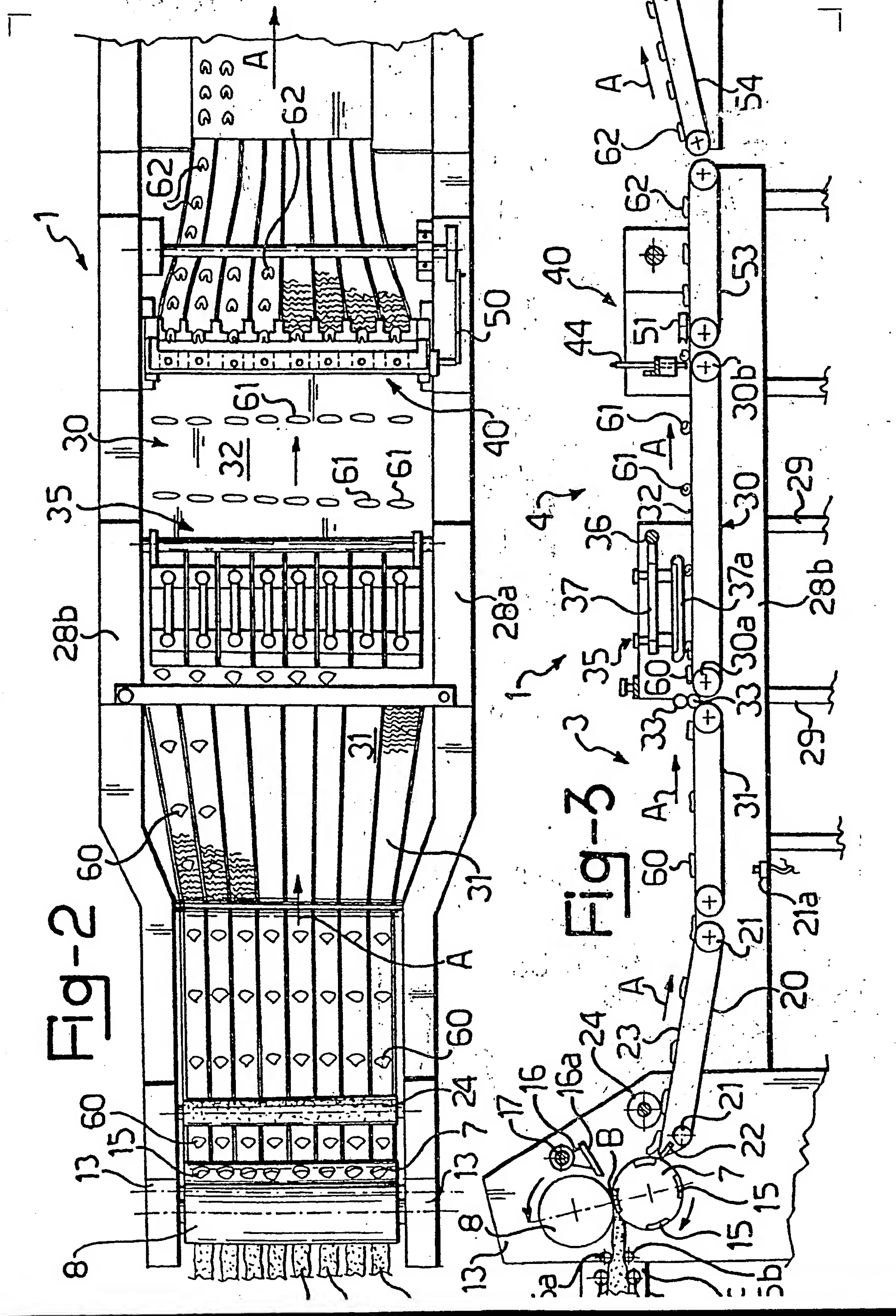

Fig-2

Fig-3

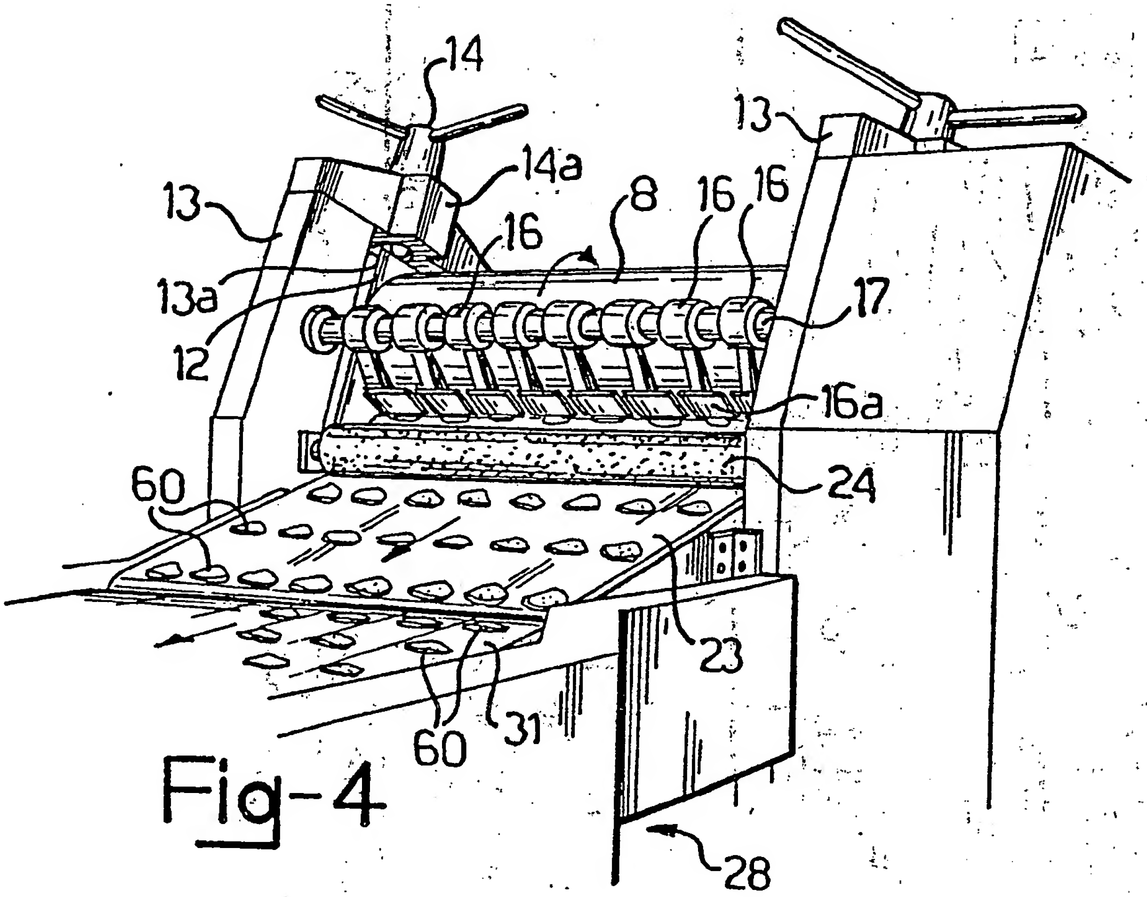
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Fig-4

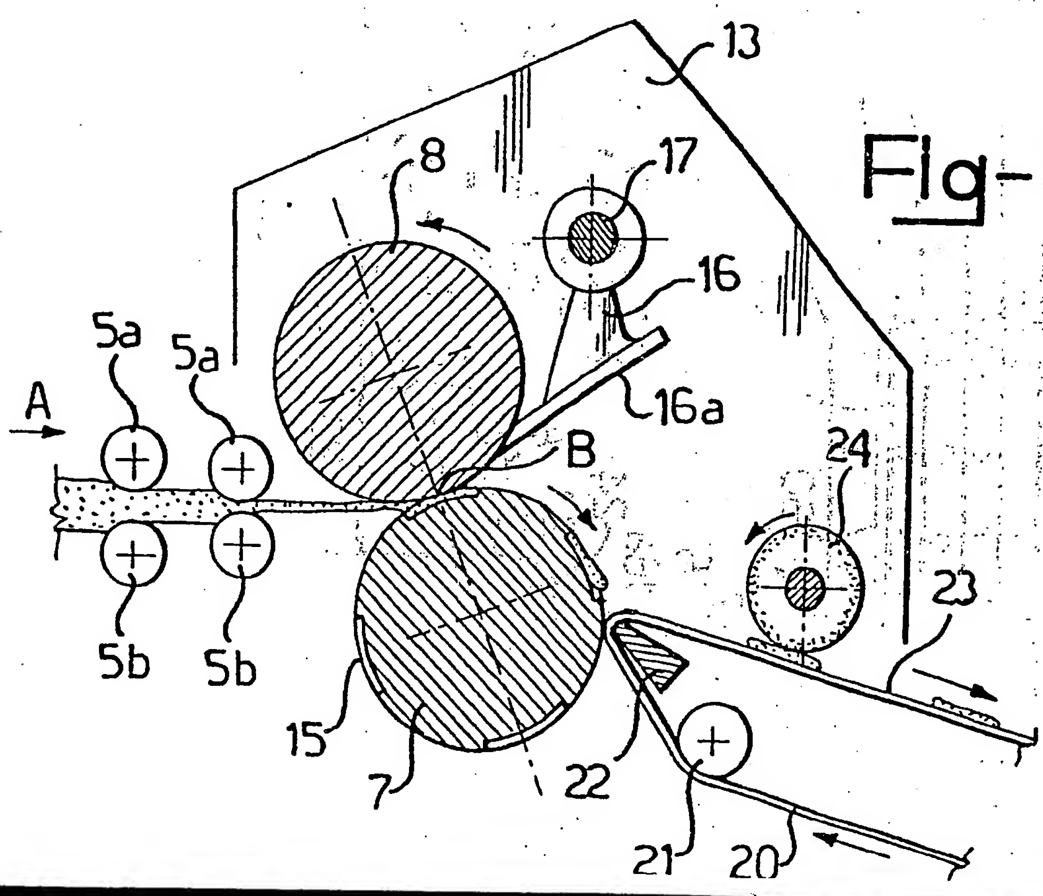
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Fig-5

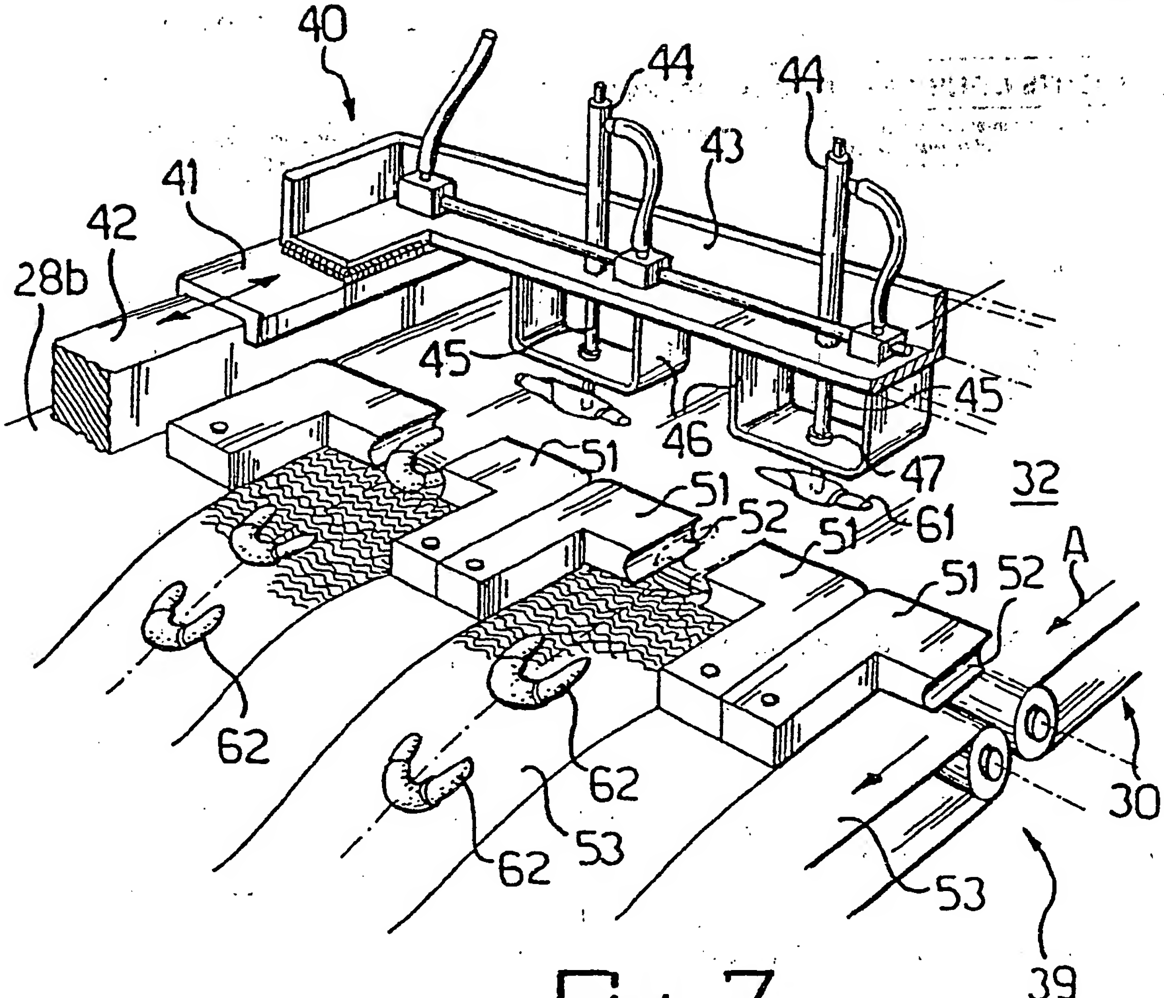
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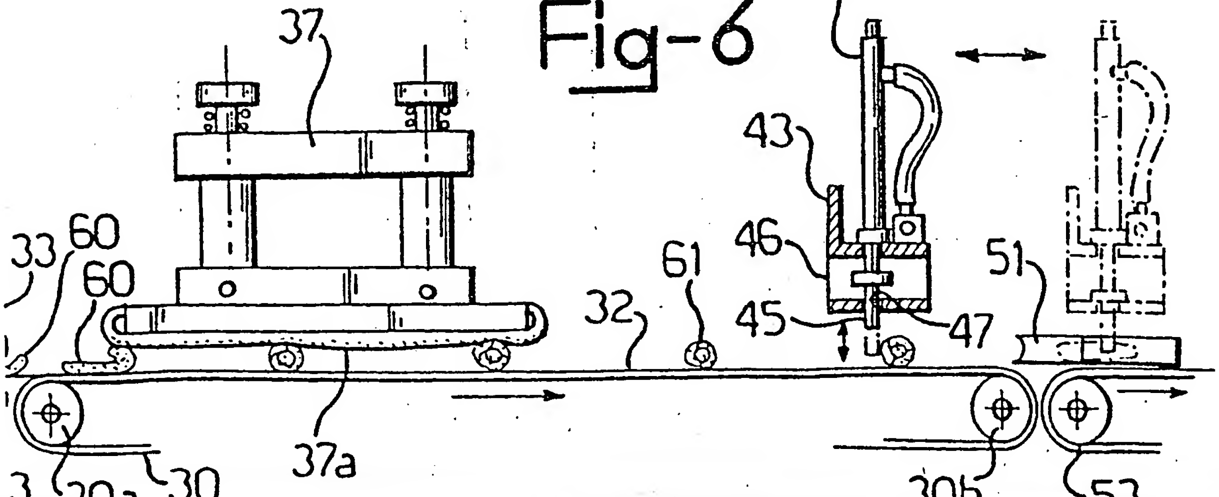
Fig-7

Fig-6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EUROPEAN SEARCH REPORT

0207903

Application number

EP 86 83 0182

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl.4)
A	US-A-4 389 176 (C. NENCI) * Whole document *	1-3	A 21 C 3/06
A	US-A-4 046 920 (R.V. MOLINE) * Column 7, lines 10-50; figure 6 *	1-3	
A	US-A-4 276 800 (D.A. KOPPA et al.)	1,2	
A	EP-A-0 115 108 (E.J. BENJAMIN et al.) * Page 14, line 20 - page 15, line 10 *	1	
A	US-A-4 469 711 (E. SELTZER) * Column 6, lines 1-4 *	1	TECHNICAL FIELDS SEARCHED (Int Cl.4)
A	GB-A- 835 240 (BAKER PERKINS LTD.) * Figures 1-5 *	7,10	A 21 C A 21 D A 23 L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29-09-1986	FRANKS N.M.

CATEGORY OF CITED DOCUMENTS

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